REMARKS

Claims 1 through 45 are pending herein. By the Office Action, claims 6, 14, 26, and 39 are rejected under 35 U.S.C. 112, first paragraph. Claims 1-17, 22-29, and 34-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gounares et al. (U.S. Pat. No. 6,088,690) in view of Black (U.S. Pat. No. 6,269,351). Claims 18-21, and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gounares et al. in view of Black and further in view of Kimbel et al. (U.S. Pat. No. 5,517,654). By this amendment, claims 1, 10, 22, 34, 35, and 45 are amended; claims 6, 14, 26, and 39 are canceled. No new matter is added. Applicants respectfully traverse the rejection.

Rejection of Claims under U.S.C. 112

In the Office Action, claims 6, 14, 26, and 39 were rejected as failing to comply with the enablement requirement through not addressing transforming the problem solution. By this amendment, claims 6, 14, 26, and 39 are canceled. Applicants respectfully request that the rejection be withdrawn.

Rejection of Claims Under U.S.C. 103(a)

The amendments to claims 1, 10, 22, 34, 35, and 45 are broadening amendments submitted to more fully claim that which is applicant's invention, and are not intended to limit or narrow the scope of the claims or to effect the Doctrine of Equivalents as it might be applied to the claims, were they unamended.

Claims 1-17, 22-29, and 34-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gounares et al. (U.S. Pat. No. 6,088,690) in view of Black (U.S. Pat. No. 6,269,351). Claims 18-21, and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gounares et al. in view of Black and further in view of Kimbel et al. Applicants respectfully traverse the rejection.

Applicants believe that the claims as amended hereby patentably distinguish over the cited art in its capability for handling problems which are non-input-output mapping problems, in its use of complexity aware models, in the use of problem complexity

related bound computations, in adjusting the problem complexity by changing the problem rather than the algorithm, and finally in adjusting the computation resources based on problem complexity. Specifically, claims 1, 10, 22, 34, 35, and 45 amended to more clearly set forth the functionality of the complexity module and the adaptation process, which permits problem modification to address solution requirements of optimization problems which are intrinsically difficult to solve.

Black attempts to solve a ***fixed*** quite limited problem, namely to generate a neural network that takes training set inputs and generates training set outputs with the least error. In its most general application, it is to learn a mapping from known inputs to known outputs. Black then focuses on solving this ***fixed*** problem as efficiently as possible. Solutions to this fixed mapping problem include adjusting the learning rate, changing the number of nodes in the neural net model, or generating new starting points.

Unfortunately, it is now known that there are optimization problems which are intrinsically difficult to solve. These optimization problems take, on average, an unacceptably long time to solve regardless of the algorithm, its efficiency at going from a starting point to new minima, or algorithm adjustments. Every parameter or algorithm that Black chooses to implement will not result in average rates of improvements that exceed a certain bound for these problems. Moreover, the rate of improvement for new optima will, on average, never exceed a limiting rate. Finally, it is also known that problems that seem very similar with the same optimization function, similar numbers of variables, and similar numbers of constraints can have quite different optimization difficulties. These intrinsically difficult optimization problems must be recognized quickly and dealt with. To handle these problems, there are four choices:

1. Give up and return an error,
2. Accept the best result possible given fixed computational resources,
3. Add computational resources of memory, clock cycles, processors, and
4. Change the problem to one that is easier to solve.

The subject application teaches (a) identification of such intrinsically difficult problems (claim 1, comparing expected and actual solver behavior), (b) estimation of the

fundamental average rate of improvement vs. computation tradeoff (claim 1, adaptation), and (c) selecting one of the four choices above, including changing the problem to a similar but intrinsically easier problem (claim 1, adaptation). Black does not anticipate that there are intrinsically difficult problems so the algorithm always attempts to adjust the algorithm. Black assumes that a poor rate of improvement is a problem of the algorithm. Finally, Black never adjusts the optimization problem itself, and does not anticipate the complexity module taught herein.

Black is directed toward a neural network. In Black's words, "The role of an ANN is to perform a non-parametric, nonlinear, multi-variate mapping from one set of variables to another. ANN 10 of FIG. 1 illustrates such a mapping by operating on input vector 12 to produce output vector 14. To perform this mapping, a training algorithm is applied to deduce the input/output relationship(s) from example data." (Black, column 1, lines 17-24). Black deals most generally with learning an input-output mapping.

Gounares applies only for discrete sequential problems which are combinatorial in nature. The Gounares invention 'optimizes' a fitness function over a discrete combinatorial action space. Even the fitness function is discrete: either an action sequence produces a 'defect' (unexpected changes in properties) or not. Random combinations of sequences that produce 'defects' are expected to more likely produce 'defects' than not. In a continuous search space the notion that a small change in the search space that gives a small change in the objective function implies that a bigger change in the same direction leads to a larger change in the objective function.

The invention in Gounares only uses random combinations in order to create new steps. There is nothing purposeful about the 'evolution' of solutions; the evolution is strictly random. The present application, on the other hand, encompasses the possibility of random combinations but more frequently the combinations are proscribed by a specific search strategy. Also in Gounares, the procedure for generating new offspring from old chromosomes is fixed (as shown in Figs. 4, 8, and 10). Thus, there is a fixed method for randomly generating new sequences from old. Knowledge about new combination strategies that yield greater rates of change in the fitness function are not used to change the algorithm. There is no notion that some fitness optimization problems

are intrinsically difficult and therefore the optimization problem should be changed unlike the present application. In the present application, new search algorithms are implemented, not just new instances of existing algorithms.

Kimbel et al. teaches the use of an embedded computer to implement combinatorial optimization in a multiprocessor network. The system of Kimbel operates as an intermediary between a root processor and a multiprocessor network and generates shadow nodes which are used to occupy idle capacity available within the multiprocessor network. Kimbel does not teach the functionality of the complexity module nor does it teach the adaptation process.

Applicants believe that the claims as amended hereby patentably distinguish over the cited art because of the presence of a complexity module and its interaction with the solver module, complexity prediction, adaptation, and incremental generation and evaluation of solutions.

In view of the foregoing, it is submitted that the cited prior art fails to teach all of the features of the applicants' invention. Because the cited art does not teach all of the features taught by the specification and amended claims of the subject application, applicants believe that the subject application is patentably distinguished from the cited art. Therefore, it is respectfully requested that the rejection of claims 1, 10, 22, 34, 35, and 45 be withdrawn.

Insofar as claims 2-5, 7-9, 11-13, 15-21, 23-25, 27-33, 36-38, and 40-43, inclusive, are concerned, these claims all include the limitations of and depend from now presumably allowable amended claims 1, 10, 22, 34, and 35 respectively and are also believed to be in allowable condition for the reasons hereinbefore discussed with regard to claims 1, 10, 22, 34, and 35. Reconsideration and withdrawal of the rejection are respectfully requested.

In view of the foregoing amendments and remarks, applicants respectfully submit that the application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

Entry of the above amendments is respectfully requested.

No additional fee is believed to be required for this amendment. However, the undersigned Xerox Corporation Attorney hereby authorizes the charging of any necessary fees, other than the issue fee, to Xerox Corporation Deposit Account No. 24-0025. This also constitutes a request for any needed extension of time and authorization to charge all fees therefor to Xerox Corporation Deposit Account No. 24-0025.

In the event the Examiner considers personal contact advantageous to the disposition of this case, s/he is hereby authorized to call Applicant's Attorney, Linda M. Robb, at telephone number (310) 333-3683, El Segundo, California.

Respectfully submitted,

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November 30, 2004
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